

## Factors that Undermine Service Delivery by Civil Engineers in South African Local Municipalities

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### Abstract

The objective of study was to identify and quantify key predictors of job satisfaction among civil engineers working in South African local municipalities. The design of study was cross-sectional, descriptive and evaluative. The study was conducted against the background of shortage of suitably qualified, adequately motivated and skilled civil engineers working in local municipalities. The degree of job satisfaction of respondents was assessed by using a composite index developed by Turkyilmaz, Akman, Ozkan and Pastuszak (2011) for conducting a similar study. A combination of quantitative and qualitative methods of data collection and analyses were used in the study. As part of the quantitative aspect of study, data was collected from a stratified random sample of size 250 civil engineers working in various South African local municipalities. As part of the qualitative aspect of study, individual in-depth interviews were conducted with 37 civil engineers working in various local municipalities. Four focus group interviews were conducted as part of the study. Data was collected by using a structured, pretested and validated questionnaire of study. Quantitative data analyses were conducted by using methods such as frequency tables, cross-tab analyses (Pearson's chi-square tests of associations) and binary logistic regression analysis. The results showed that 171 of the 250 respondents who took part in the study (68.40%) were satisfied with the job that they were performing in the various local municipalities, whereas the remaining 79 of the 250 respondents in the study (31.60%) were not satisfied with their jobs. Based on results obtained from cross-tab analyses at the 5% level of significance, the degree of job satisfaction of civil engineers at the workplace was significantly and adversely affected by too much workload, poor working conditions, lack of budget for construction projects, low salary and remuneration, lack of training opportunities, lack of cooperation and appreciation, too much bureaucracy and red tape, short duration of service, and poor relationship with supervisors, in a decreasing order of strength. Results obtained from binary logistic regression analysis showed that the degree of job satisfaction of civil engineers at the workplace was significantly and adversely affected by 3 factors. These 3 factors were too much workload, poor working conditions, and lack of budget for construction projects in a decreasing order of strength. Results obtained from individual and focus group in-depth interviews led to similar findings.

*Keywords:* Civil Engineers; Municipal Service Delivery; Job Satisfaction; Logit Analysis.

### 1. Introduction and Background

Studies conducted by the South African Council for the Built Environment (2016), Alinaitwe, Apolot & Tindiwensi (2013), Watts & Charles (2015) and Barfield & Dingus (2014) have shown that civil engineers working for local municipalities on the construction and maintenance of public infrastructure perform optimally under circumstances in which there is sound leadership and adequate adherence to good corporate governance principles [1- 4]. Sadie, Patel and Baldry (2016) have pointed out that protests over municipal service delivery in almost all South African municipalities are a result of poor service quality, lack of good governance, lack of housing, lack of good leadership, failure to repair and maintain infrastructure, lack of technical, managerial and artisan skills and the abuse of power by elected officials

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[5]. The annual report issued by the South African National Department of Cooperative Governance and Traditional Affairs (2016) shows that poor municipal service delivery exacerbates unemployment and abject poverty among the masses and the unemployed youth in South African local municipalities [6]. A report issued by the South African Institute of Civil Engineering (SAICE, 2015) shows that the acute shortage of civil engineers working in the public sector undermines the capacity of local municipalities to maintain and expand infrastructure in almost all local municipalities [7]. Pillay and Watermeyer (2012) have pointed out that civil engineers working in local municipalities are exposed to work overload, job dissatisfaction and lack of resources such as finance, engineering equipment, heavy machinery, lack of training opportunities and lack of skilled manpower [8]. Civil engineers currently account for less than half of all professional engineers and technologists registered with the Engineering Council of South Africa (ECSA) and are responsible for conducting activities such as drawing up strategic and operational plans for construction projects, optimization of resources, the assessment and maintenance of infrastructure, the development of short, medium and long-term infrastructure plans, acquisition, and the refurbishment and rehabilitation of infrastructure. The profession of civil engineering is regulated by the Engineering Council of South Africa (ECSA), and there are professional codes of conduct that govern the practice of civil engineering. The Council for the Built Environment (CBE) is the overall statutory body established by legislation in terms of the CBE Act of 2000 (Act no. 43 of 2000). The CBE is responsible for ensuring service level standards and professional conduct among building construction practitioners, surveyors, construction project managers, engineers, architects, quantity surveyors, property valuers and landscape architects. The regulatory functions carried out by the CBE are the identification of professional work, setting up guidelines on professional fees, ensuring continuous professional development (CPD), accreditation of built environment qualifications offered by universities, setting a code of conduct for the respective professions, overseeing professional registration standards, recognition of voluntary associations, recognition of new professions, international agreements, recognition of prior learning, generating and ensuring compliance with professional standards, overseeing appeals and tribunals and setting competency standards for registrations.

The study was conducted in order to assess and evaluate the current situation in which civil engineers work in South African municipalities. There is a shortage of such studies in the relevant literature. Civil engineers working in local municipalities are required to maintain and expand infrastructure in order to accommodate the needs of the growing South African population and highly diverse construction-related needs of the general public. The scarcity of suitably qualified and adequately experienced civil engineers is significantly associated with inability to maintain and expand infrastructure. The shortage of municipal civil engineers is also associated with inability to manage municipal assets and adjudicate municipal tenders objectively.

The overall objective of this study was to identify and quantify key barriers that undermine the provision of services by civil engineers in South African local municipalities by the standards of Turkyilmaz, Akman, Ozkan and Pastuszak (2011) developed for large urban centres [9]. The study was conducted in order to assess and evaluate factors that affect job satisfaction and productivity by South African civil engineers working in local municipalities.

## 2. Literature Review

Kitchin (2014) and Campbell (2007) have pointed out that in order for civil engineers to perform optimally in major urban centres, it is essential to create an economically enabling environment in which administrators adhere to good corporate governance principles [10, 11]. Halbesleben, Neveu, Paustian-Underdahl and Westman (2014) have reported that overall productivity and job satisfaction are significantly associated with the degree to which resources are made available at the workplace [12]. According to Abbas, Raja, Darr and Bouckenoghe (2014), the overall productivity of institutions and degree of job satisfaction are both significantly influenced by factors such as leadership quality, the degree of adherence to sound leadership and management principles and the provision of practical incentives such as workplace training opportunities [13]. The study explores the relationship between job satisfaction and the socioeconomic backgrounds of employees in order to assess and evaluate overall productivity at the workplace by the standards of De Been and Beijer (2014) [14]. The authors have pointed out that the overall performance and degree of job satisfaction of public sector employees depends on factors such as the provision of incentives such as workplace training, good leadership, good governance, and the availability of logistical and financial resources that are necessary for routine operation. The study conducted by Whitfield and Buur (2014) has found that the degree of job satisfaction and the productivity of public sector employees decrease with increased interference from administrators and managers on technical issues at the workplace [15].

Studies conducted in South Africa by Murray (2013) on the public sector have shown that the quality of public service delivery is often undermined by factors such as nepotism, cronyism, lack of professionalism, lack of skills, lack of good leadership, lack of adherence to good governance principles and the appointment of political administrators to technical positions [16]. A report issued by the South African Auditor-General (2016) for the financial year 2014/2015 shows that only 32% of the all district municipalities in South Africa received clean audit reports [17]. According to the Institute of Directors Southern Africa (2016), the key obstacles to adequate compliance were poor adherence to the Public Finance Management Act (Act no. 1 of 1999), lack of specialised skills, political infights among employees, labour-related disputes and unrest, protests over poor service delivery, lack of managerial and leadership skills, and failure to

adhere to good governance principles [18]. The annual report published by the South African Local Government Association (SALGA, 2016) for the financial year 2014/2015 shows that only 4% of Councillors have a university degree, 16% a diploma and that 30% of municipal Councillors have a certificate qualification [19]. The report shows that lack of capacity was a significant obstacle to adequate municipal service delivery in all local municipalities. The report shows that 50% of municipal Councillors had Grade 12 qualifications or less. About 67% of municipal councillors were in office for the first term, whereas 25% of councillors were in office for the second term, and that only 8% of municipal councillors were in office for a third term or longer.

The South African Government published the National Development Plan (Alden and Schoeman, 2013) in the year 2011 for ensuring adequate municipal service delivery at all South African local municipalities [20]. The plan acknowledges the critical importance of artisan and vocational skills for ensuring adequate municipal service delivery. One of the critical skills in the National Development Plan is civil engineering. Local municipalities are encouraged by the National Development Plan to actively recruit adequately qualified and well experienced civil engineers for ensuring adequate service delivery in local municipalities. However, the plan has not been implemented adequately at municipal levels. The National Planning Commission (NPC) was established in 2011. According to the HSRC (2016), about 90% of all positions in local municipalities require technical skills and expertise that are essential for providing adequate municipal services to the general public [33]. The critical shortage of artisan and vocational skills undermines the capacity of local municipalities to provide satisfactory municipal services to the general public. Based on a study conducted in Ghana, Ofori (2015) has pointed out that the inability of local municipalities to provide workplace training opportunities and collaborate with universities is a major obstacle that undermines the quality of municipal services and the optimal utilisation of resources [21]. Khale (2015) has pointed out that key areas of scarce skills include artisans, auto mechanics, machinists, electricians, plumbers, carpenters, quantity surveyors, plant operators, civil engineers, town planners, machine operators, drillers, welders, drivers, sanitation engineers, wastewater process controllers, waste recyclers, auditors, accountants and data analysts [22]. Studies conducted by Edoho (2015) and Marivate (2014) have shown that failure to provide adequate municipal services to newly established businesses is a key cause of failure in start-up business enterprises, and that almost half of all newly established businesses fail in their first three years of operation in South Africa [23, 24]. According to Rasool and Botha (2011), the migration of skilled workers and technicians out of South Africa to countries such as Australia, New Zealand and Canada has resulted in a severe shortage of adequately skilled employees in almost all local municipalities in South Africa [24]. Watson (2014) has shown that African local municipalities are unable to grow and develop on a sustainable basis mostly due to lack of adequately qualified and skilled civil engineers, architects, town planners, quantity surveyors and construction workers [26].

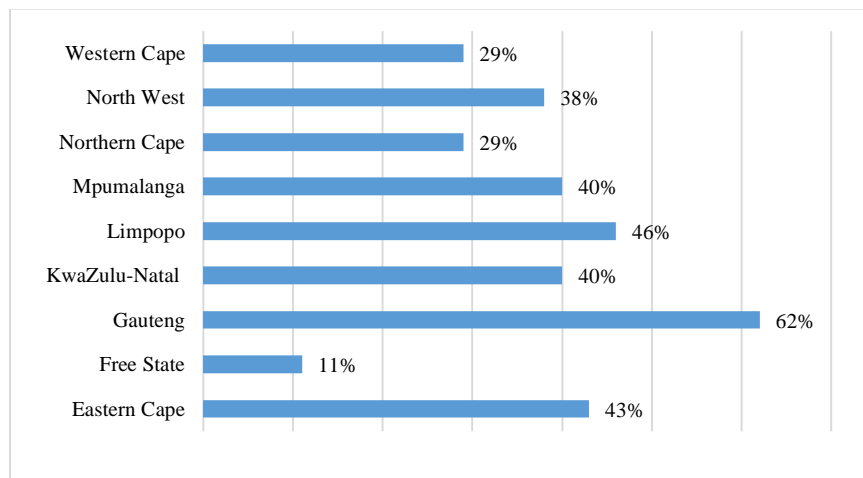
The study conducted by Pooe, Worku and Van Rooyen (2016) shows that almost all South African local municipalities lack of skilled employees such as chartered accountants, building and construction technicians, civil engineers, architects, health professionals and surveyors [27]. Khale (2015) has pointed out that the inability of local municipalities to provide workplace training opportunities and collaborate with universities is a major obstacle that undermines the quality of municipal services and the optimal utilisation of resources such as finance [21]. Khale and Worku (2015), Marivate (2014) and Seeletse (2012) have pointed out that local municipalities often fail to meet their Key Performance Indicators (KPIs) due to lack of leadership and specialised skills [24, 28, 29]. Civil engineers are critically needed for implementing essential municipal services in all South African local governments and municipalities. The profession of civil engineering is a rare discipline that is characterised by an acute shortage of suitably qualified civil engineers. The majority of civil engineers in South Africa work in the private sector due to remuneration and better working conditions.

According to the South African Services SETA (2016), South African local municipalities employ about 5% of all employees in South Africa (about 278, 000 people) and contribute about 2% to GDP [30]. Table 1 shows the distribution of skills among employees working in South African local municipalities. It can be seen from the table that the Western Cape, Gauteng and the Eastern Cape fare relatively better than the remaining six provinces in South Africa with regards to skilled employees.

**Table 1. Distribution of municipal employees by province and occupational level [30]**

| Province      | Employees in leadership positions (%) | Highly skilled employees (%) | Semi-skilled employees (%) | Unskilled employees (%) |
|---------------|---------------------------------------|------------------------------|----------------------------|-------------------------|
| Eastern Cape  | 6                                     | 25                           | 26                         | 43                      |
| Free State    | 3                                     | 12                           | 35                         | 11                      |
| Gauteng       | 5                                     | 11                           | 22                         | 62                      |
| KwaZulu-Natal | 5                                     | 9                            | 46                         | 40                      |
| Limpopo       | 8                                     | 12                           | 34                         | 46                      |
| Mpumalanga    | 15                                    | 10                           | 35                         | 40                      |
| Northern Cape | 6                                     | 19                           | 47                         | 29                      |
| North West    | 9                                     | 10                           | 44                         | 38                      |
| Western Cape  | 11                                    | 26                           | 46                         | 29                      |

According to the South African Services SETA (2016), the capacity of South African municipalities to provide satisfactory municipal services is significantly undermined by the acute shortage of skilled employees at municipal level [30]. Figure 1 shows the percentage of unskilled employees in South African municipalities. It can be seen from the figure that Gauteng Province, Limpopo Province and the Eastern Cape have the top three percentage of unskilled employees with 62%, 46% and 43% respectively.



**Figure 1. The percentage of unskilled employees by province [30]**

According to Koma (2010), the acute shortage of qualified artisans, vocational experts, quantity surveyors, builders, plumbers, accountants, auditors, electricians, machine operators, architects and civil engineers working in local municipalities is a key cause of protests at South African local municipalities [31]. The study conducted by Badat and Sayed (2014) has shown that skilled employees often leave the public sector for the private sector in search of better working conditions and employee benefits [32]. The HSRC (2016) has also reported similar findings [33].

The South African Municipal Systems Act of 2000 (Act number 32 of 2000) states that local municipalities are responsible for the identification, acquisition, recruitment and retention of talents and skills that are essential for efficient municipal service delivery. However, Koma (2010) has pointed out that local municipalities are bleeding their skilled employees, technicians and artisans to the private sector [31]. Although the Act requires local municipalities to establish systems, procedures and structures for the development of human resources and skills, local municipalities are experiencing an acute shortage of specialised skills. South African local municipalities are split into three categories (A, B and C). Category A municipalities are metropolitan areas. Category B municipalities are district municipalities. Category C municipalities are local municipalities. According to the HSRC (2016), there are 8 metropolitan municipalities, 44 district municipalities and 205 local municipalities in South Africa [33].

The annual report issued by the South African Auditor-General (2016) for the financial year 2014/2015 shows that all South African local municipalities that were given qualified audit reports were characterised by shortage of adequately skilled workforce, inability to attract and retain skilled technical employees and failure to adhere to good governance principles [17]. The study conducted by Pooe, Worku and Van Rooyen (2016) has shown that all local municipalities are unable to meet their mandates to the general public and stakeholders unless they have adequately skilled employees such as chartered accountants, construction and building specialists, civil engineers and architects [27]. The acute shortage of skilled technicians has undermined the quality of municipal service delivery in all South African local municipalities. According to Seeletse (2012), at the local municipal level, there can be no adequate municipal service delivery without suitably qualified and adequately experienced technicians such as civil engineers [29]. The majority of South African local municipalities suffer from an acute shortage of civil engineers who can lead projects directed at municipal service delivery. Table 2 shows the distribution of building and construction employees for the years 2008 to 2011.

**Table 2. Employees in the South African building and construction industry [6]**

| Qualifications                    | 2008           | 2009           | 2010           | 2011           |
|-----------------------------------|----------------|----------------|----------------|----------------|
| Engineers                         | 26, 789        | 28, 221        | 33, 245        | 34, 664        |
| Architects                        | 10, 465        | 12, 487        | 11, 663        | 10, 517        |
| Construction and project managers | 3, 276         | 3, 418         | 3, 624         | 3, 103         |
| Quantity surveyors                | 2, 666         | 2, 537         | 2, 687         | 2, 900         |
| Property valuers                  | 2, 557         | 2, 536         | 2, 375         | 2, 304         |
| Landscape architects              | 104            | 144            | 159            | 187            |
| <b>Total</b>                      | <b>45, 857</b> | <b>49, 343</b> | <b>53, 753</b> | <b>53, 675</b> |

According to Murray (2013), 75.4% of engineering professionals in South Africa are employed in the private sector by consulting engineering companies while the remaining 24.6% are employed in the public sector [16]. The author has pointed out that 6.08% of engineering professionals are employed in national departments, 14.46% in provincial departments, 9.3% in local municipalities, and 70.1% in state owned enterprises [16]. Table 3 shows the distribution of registered engineers in South Africa by economic sector.

**Table 3. Distribution of registered engineers by economic sector [6]**

| <b>Economic sector</b>       | <b>Percentage of registered engineers</b> |
|------------------------------|---|
| Engineering consulting       | 31%                                       |
| Energy or power              | 12%                                       |
| Mining                       | 12%                                       |
| Engineering or manufacturing | 9%  |
| Chemical or petroleum        | 7%  |
| Construction industry        | 6%  |
| Utilities industry           | 3%  |
| Government Departments       | 3%  |
| Telecommunications           | 3%  |
| Transportation industry      | 2%  |
| Aerospace or defence         | 1%  |
| Education or teaching        | 1%  |
| Public service               | 1%  |
| Metals                       | 1%  |
| Academic research            | 1%  |
| Forestry or agriculture      | 1%  |
| Management or cConsulting    | 1%  |
| Automotive                   | 1%  |

### 3. Materials and Methods

The design of study was descriptive and cross-sectional. The sample size of study was equal to 250. Stratified random sampling was used for selecting eligible respondents for the study. The respondents were professional engineers, technicians and technologists. Respondents were selected from all 9 provinces of South Africa. Data was collected from respondents by using a structured, pre-tested and validated questionnaire of study. The dependent variable of study (Y) was degree of job satisfaction. The degree of job satisfaction of respondents was measured by using a composite index developed by Turkyilmaz, Akman, Ozkan and Pastuszak (2011) for conducting a similar study [9].

$$Y = \begin{cases} 1 & \text{if employee has no job satisfaction} \\ 0 & \text{otherwise} \end{cases}, \quad Y: \text{Degree of job satisfaction of employee}$$

Frequency tables, cross-tab analyses or Pearson's chi-square tests of association (Hair, Black, Babin & Anderson, 2010) and binary logistic regression analysis (Hosmer & Lemeshow, 2013) were used for data analyses [34, 35]. As part of the qualitative aspect of study, data was collected from 37 individual respondents by using a tape recorder. Interviews obtained from respondents were later transcribed, coded and tallied. Thematic analysis was done in order to assess and evaluate factors that were responsible for job dissatisfaction and lack of productivity among civil engineers and construction workers employed by South African local municipalities.

### 4. Results of Data Analyses

The results showed that 171 of the 250 respondents who took part in the study (68.40%) were satisfied with the job that they were performing in the various local municipalities by the standards of Turkyilmaz, Akman, Ozkan and Pastuszak (2011), whereas the remaining 79 of the 250 respondents in the study (31.60%) were not satisfied with their jobs by the same standards [9].

**Table 4. General characteristics of respondents (n=250)**

| Characteristics                | Percentages                              |
|--------------------------------|--|
| Job satisfaction               | Satisfied: 68.40%                        |
|                                | Not satisfied: 31.60%                    |
| Highest level of education     | Matric level or less: 15.28%             |
|                                | Certificate: 18.12%                      |
|                                | Diploma: 32.00%                          |
|                                | Bachelor's degree: 24.35%                |
|                                | Master's degree or above: 10.25%         |
| Age categories of respondents  | 24 to 33 years: 3.8%                     |
|                                | 34 to 43 years: 23%                      |
|                                | 44 to 53 years: 30.76%                   |
|                                | 54 to 62 years: 37.17%                   |
|                                | R15, 000 to R25, 000: 6.41%              |
| Average monthly salary in Rand | R25, 001 to R35, 000: 15.35%             |
|                                | R36, 001 to R45, 000: 34.60%             |
|                                | R45, 001 or above: 20.50%                |
|                                | Individually negotiated salaries: 23.14% |
|                                | 2 years or less: 15.38%                  |
| Duration of service in years   | 3 to 6 years: 45.58%                     |
|                                | 7 to 10 years: 36.48%                    |
|                                | More than 10 years: 2.56%                |
|                                | Male: 89%                                |
| Gender of respondent           | Female: 11%                              |
|                                | Black: 62.80%                            |
| Racial category of respondents | White: 19%                               |
|                                | Coloured: 10%                            |
|                                | Indian: 7.69%                            |

Table 4 provides percentages for the general characteristics of the 250 respondents who took part in the study. It can be seen from the table that about 15% of respondents had matric level qualifications or less. The percentage of male respondents was 89%, whereas the percentage of female respondents was only 11%. About 63% of respondents were black. About 19% of respondents were white. About 10% of respondents were coloured. About 8% of respondents were Indian. The percentage of respondents with Bachelor's degree was equal to 24.36%. The percentage of respondents with Master's degrees or more was about 10%. About 24% of respondents had Bachelor's degrees. The majority of respondents had national diplomas (32.0%). About 4% of respondents had ages of 24 to 33 years. About 23% of respondents had ages of 34 to 43 years. About 31% of respondents had ages of 44 to 53 years. About 37% of respondents had ages of 54 to 62 years.

The percentage of employees who served for two years or less was equal to 15.38%. About 46% of respondents had served local municipalities for three to six years. About 37% of employees had served local municipalities for seven to ten years. About 3% of employees had served local municipalities for more than ten years. About 6% of respondents were paid an average monthly salary of R15, 000 to R25, 000. About 15% of respondents were paid an average monthly salary of R25, 001 to R35, 000. About 35% of respondents were paid an average monthly salary of R36, 001 to R45, 000. About 21% of respondents were paid an average monthly salary of R45, 001 or above. About 23% of respondents were paid individually negotiated monthly salaries. Table 5 provides percentages for the registration status and functional areas of the 250 respondents who took part in the study.

**Table 5. Functional areas of respondents (n=250)**

| Characteristics                    | Percentages                                     |
|------------------------------------|---|
| Level of seniority or rank         | Junior employee: 6.41%                          |
|                                    | Skilled junior employee: 24.36%                 |
|                                    | Junior manager: 42.31%                          |
|                                    | Senior manager: 26.92%                          |
|                                    | Not registered: 34.6%                           |
|                                    | De-registered: 28.2%                            |
| Registration status of respondents | Registered candidate with ECSA: 15.4%           |
|                                    | Registered candidate with other councils: 1.28% |
|                                    | Registered technician: 8.9%                     |
|                                    | Registered technologist: 6.41%                  |
|                                    | Registered engineer: 5.12%                      |
| Functional areas of respondents    | Water and waste water management: 23%           |
|                                    | Sanitation: 16.6%                               |
|                                    | Solid waste management: 7.6%                    |
|                                    | Roads and storm water management: 17.9%         |
|                                    | Electricity: 5.1%                               |
|                                    | Project management: 14.1%                       |
|                                    | Asset management: 3.8%                          |
|                                    | Housing construction: 11.5%                     |

|                                 |   |
|---------------------------------|---|
| Source of experiential learning | Same municipality: 15.38%                 |
|                                 | Other municipalities: 12.82%              |
|                                 | The private sector: 38.46%                |
|                                 | National or Provincial Government: 14.10% |
|                                 | State Owned Enterprise (SOE): 19.20%      |

It can be seen from the table that the percentage of junior employees was equal to 6.41%. The percentage of skilled junior employees was equal to 24.36%. The percentage of employees who were junior managers was equal to 42.31%. The percentage of employees who were senior managers was equal to 26.9%.

The percentage of respondents who were registered with the Engineering Council of South Africa (ECSA) was equal to 15.4%. The percentage of respondents who were not registered with the ECSA was equal to 34.6%. The percentage of de-registered respondents was equal to 28.2%. The percentage of registered technicians was equal to 8.9%. The percentage of registered technologists was equal to 6.41%. The percentage of registered engineers was equal to 5.12%. The percentage of respondents who were registered with other professional councils was equal to 1.28%. About 15% of respondents managed to acquire experiential training from the same municipality where they were working. About 13% of respondents managed to acquire experiential training from other municipalities. About 38% of respondents managed to acquire experiential training from the private sector. About 14% of respondents managed to acquire experiential training from the South African National Government or from Provincial Governments. About 19% of respondents managed to acquire experiential training from State Owned Enterprises (SOEs). About 23% of respondents worked on water and waste water management. About 17% of respondents worked on sanitation. About 8% of respondents worked on municipal solid waste management. About 18% of respondents worked on road construction, maintenance and storm water management. About 5% of respondents worked on electrical tasks. About 14% of respondents were responsible for managing municipal projects. About 4% of respondents were responsible for asset management. About 12% of respondents were responsible for housing construction.

The Pearson chi-square test of association (Hair, Black, Babin and Anderson, 2010) was used for performing a preliminary screening of influential factors that were significantly associated with job satisfaction by 250 respondents who took part in the study [34]. The degree of job satisfaction of respondents was measured by using a composite index developed by Turkyilmaz, Akman, Ozkan, Pastuszak and Worku (2011) for conducting a similar study [9]. Pearson's chi-square tests of association were performed between values of variable Y and each of the factors that are known to affect job satisfaction in South African local municipalities. The results showed that job satisfaction was significantly associated with 5 factors at the 5% level of significance. At the 5% level of significance, significant two-way associations are characterized by large observed chi-square values and P-values that are smaller than 0.05. Table 6 shows 9 significant two-by-two associations obtained from cross-tab analyses at the 5% level of significance.

**Table 6. Significant associations obtained from cross-tab analyses (n=250)**

| Factors adversely affecting job satisfaction | Observed chi-square value | P-value  |
|--|---------------------------|----------|
| Too much workload                            | 12.084                    | 0.000*** |
| Poor working conditions                      | 10.1257                   | 0.000*** |
| Lack of budget for construction projects     | 9.8224                    | 0.000*** |
| Low salary and remuneration                  | 8.1077                    | 0.000*** |
| Lack of training opportunities               | 7.3257                    | 0.000*** |
| Lack of cooperation and appreciation         | 6.4114                    | 0.000*** |
| Too much bureaucracy and red tape            | 5.9454                    | 0.003**  |
| Short duration of service                    | 4.2116                    | 0.004**  |
| Poor relationship with supervisors           | 3.2039                    | 0.007**  |

**Legend:** Significance at \* P<0.05; \*\* P<0.01; \*\*\* P<0.001 levels of significance

Based on results obtained from cross-tab analyses, at the 5% level of significance, it can be concluded that the degree of job satisfaction of civil engineers at the workplace was significantly and adversely affected by the following 9 factors in a decreasing order of strength: Too much workload, poor working conditions, lack of budget for construction projects, low salary and remuneration, lack of training opportunities, lack of cooperation and appreciation, too much bureaucracy and red tape, short duration of service, and poor relationship with supervisors.

The 9 predictor variables shown in Table 6 were used for performing subsequent multivariate analysis by using binary logistic regression analysis. Results obtained from binary logistic regression analysis are theoretically more reliable than results from Pearson's chi-square tests of association (Hosmer & Lemeshow, 2013). This is because the measure of effect in binary logistic regression is the odds ratio, and not two-by-two significant associations. Binary logistic regression of analysis was performed by performing the regression of variable Y (viability) on the 9 predictor variables

of study that were identified by performing cross-tab analyses. At the 5% level of significance, influential predictors of motivation have odds ratios that are significantly different from 1, P-values that are smaller than 0.05, and 95% confidence intervals of odds ratios that do not contain 1.

**Table 7. Odds Ratios (OR) estimated from binary logistic regression analysis**

| Variable                                 | P-value | OR and 95% Confidence Intervals of Odds Ratio |
|--|---------|---|
| Too much workload                        | 0.000   | 4.24 (2.28, 7.66)                             |
| Poor working conditions                  | 0.000   | 2.68 (1.89, 5.89)                             |
| Lack of budget for construction projects | 0.001   | 2.57 (1.74, 5.56)                             |

At the 5% level of significance, 3 of the 9 variables used for binary logistic regression analysis were highly influential predictors of job satisfaction. These 3 predictor variables of study were: too much workload, poor working conditions, and lack of budget for construction projects, in a decreasing order of strength. Studies conducted by Seeletse (2012), Marivate (2014), Khale (2015) and Worku (2016) have shown that local municipalities must invest in tailor-made and skilled based training opportunities by collaborating with academic and research institutions as a means of improving their capacity to deliver quality municipal services [22, 24, 29, 36]. Halbesleben, Jonathon, Neveu, Paustian-Underdahl and Westman (2014: 1334-1364) have also reported similar findings [12].

## 5. Discussion of Results

The results have shown that 171 of the 250 respondents who took part in the study (68.40%) were satisfied with their jobs in the various local municipalities, whereas the remaining 79 of the 250 respondents in the study (31.60%) were not satisfied with their jobs. Based on results obtained from cross-tab analyses at the 5% level of significance, the degree of job satisfaction of civil engineers at the workplace was significantly and adversely affected by too much workload, poor working conditions, lack of budget for construction projects, low salary and remuneration, lack of training opportunities, lack of cooperation and appreciation, too much bureaucracy and red tape, short duration of service, and poor relationship with supervisors, in a decreasing order of strength. Results obtained from binary logistic regression analysis showed that the degree of job satisfaction of civil engineers at the workplace was significantly and adversely affected by 3 factors. These 3 factors were too much workload, poor working conditions, and lack of budget for construction projects in a decreasing order of strength. Results obtained from individual and focus group in-depth interviews led to similar findings.

Analysis of the age distribution of civil engineers shows that highly skilled and long-serving civil engineers are close to retirement. The implication is that local municipalities must recruit young civil engineers in large numbers and allow them to be mentored and educated by well experienced civil engineers. The results show that female engineers should be encouraged to work in local municipalities in order to address the current degree of gender imbalance. The study shows that the percentage of black, white, coloured and Indian civil engineers working in local municipalities was consistent with the demographic composition of South Africa. Results obtained from in-depth interviews showed that long-serving employees were generally fairly well experienced and highly skilled, and could be used for mentoring young and novice civil engineers. In general, the 250 respondents in the study were responsible for performing a wide range of functions in local municipalities. The functions included sanitation, waste management, storm water management, the repair and maintenance of roads, construction of houses, the repair and maintenance of municipal buildings, asset management and project management. All local municipalities that took part in the study experienced the shortage of adequately trained and well skilled engineers. One key aspect of the overall duty of respondents was to write and compile progress and annual reports to municipal administrators.

About 79% of municipal engineers acknowledged that experiential training was critically important for the acquisition and transfer of technical skills to beginners. They explained that there was a dire need for monitoring and evaluation programmes at the workplace as a means of ensuring value for money. About 64% of respondents indicated that it was important to provide practical incentives to top-performing employees. Examples of such incentives were workplace training opportunities and awards. About 86% of respondents stated that it was vital to assess the degree of satisfaction of customers with the quality of municipal services that were provided by employees of local municipalities. About 71% of respondents stated that it was vital to work with academic and research institutions as well as business and industry as a means of building capacity among employees of local municipalities.

About 59% of respondents acknowledged that it was vital to be registered with the Engineering Council of South Africa (ECSA). About 35% of respondents were not registered with the ECSA. About 28% of respondents were de-registered from the ECSA due to the non-payment of membership fees. About 37% of respondents were registered with the ECSA either as candidate (15.4%), professional technician (8.9%), professional technologist (6.41%) or professional engineer (5.12%). Less than 2% of respondents were registered with councils such as the South African Construction Managers Association and the South African Quantity Surveyors Association. About 62% of respondents received their



initial workplace exposure within the public sector by working for local municipalities or Provincial Governments. About 38% of respondents received their initial workplace exposure by working for the private sector. About 82% of respondents have been working for the same municipality for up to two years. Only 2.56% of respondents had an experience of working for 13 years for the same municipality.

## 6. Implications of Study

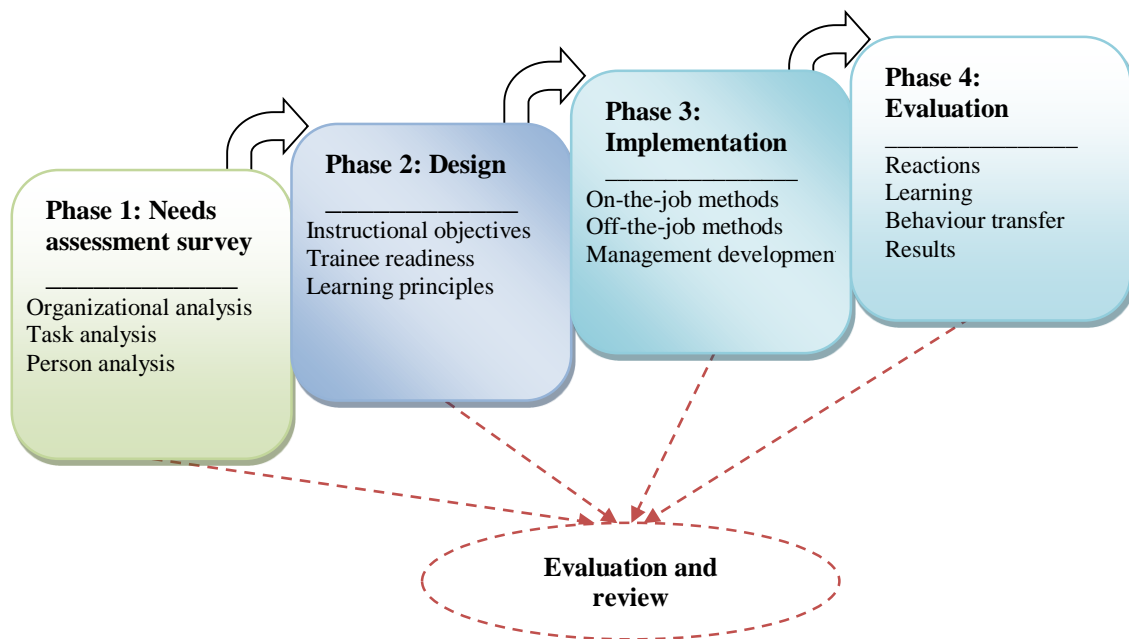
The study has shown that the following barriers undermine professionalism in the civil engineering discipline in South African local municipalities:

- 1) Lack of interest in professional registration due to a perceived lack of benefits to registered professionals
- 2) Perceived inability of the Engineering Council of South Africa (ECSA) to stop the recruitment of unregistered civil engineers in South Africa
- 3) Failure of the ECSA to provide financial subsidy or assistance for continuous professional development
- 4) The appointment of underqualified, inexperienced and unregistrable persons into technical positions in local municipalities
- 5) Inability to put an end to compromised supply chain management practices
- 6) The political appointment of underqualified and inexperienced consulting engineers and contractors
- 7) Lack of support for civil engineers from other municipal units such as Supply Chain Management (SCM) and Human Resources Management (HRM)
- 8) Low salary and benefits in comparison with the private sector
- 9) Poor career growth path and study opportunities
- 10) Lack of good governance and leadership by municipal administrators and leaders
- 11) Lack of Study opportunities
- 12) Too much workload
- 13) Underfunding and lack of budget for essential functions

The majority of municipal engineering Respondents have cited lack of interest in professional registration due to a perceived lack of benefits deriving from professional registration for the both municipal engineers as well as the employer municipality as well as hostile work environment as the key underlying reasons for poor professionalization. Halbesleben, Jonathon, Neveu, Paustian-Underdahl and Westman (2014) have shown that it is vital to provide practical incentives such as workplace training opportunities to employees working in public sector institutions as a means of keeping up morale and overall productivity [12]. The authors have pointed out that good leadership qualities and adherence to good governance principles such as objectivity, accountability and transparency are quite helpful for improving overall productivity and the degree of job satisfaction at the workplace.

Voluntary associations representing individual membership-based municipal civil engineers such as the Institute of Municipal Engineers (IMESA) and the South African Institution of Civil Engineering (SAICE) need to actively work with contractors and consultants since most consultants and contractors derive their income from the sector and have directly or indirectly caused institutional weaknesses and dependencies by municipalities to their services and expertise. Unless the Engineering Council of South Africa (ECSA) and other built environment professional Councils strengthen their regulatory oversight role over municipal engineers, the quality of services delivered to communities will be compromised due to lack of capacity.

Figure 2 shows a suitable framework that could be used by South African local municipalities for attracting, motivating, retaining and empowering professional civil engineers. The framework consists of four sequential phases.



**Figure 2. Framework for Improving the Operational Needs of Professional Civil Engineers**

Phase 1 entails a needs assessment survey. Phase 2 entails the task of designing a suitable training plan that could be used for fulfilling the training needs and requirements of civil engineers. Phase 3 entails implementation of the plan. Phase 4 entails evaluation of the plan. The framework is adapted from the framework developed by Barg, Ruparathna, Mendis and Hewage (2014) and could be used for motivating, retaining and empowering construction workers and civil engineers working in the public sector and local municipalities [37]. The framework shown in Figure 1 proposes the establishment of the following bodies:

- A team comprising monitoring and evaluation experts that specifically focuses on training and development
- The team takes a leading role in needs assessment, setting standards, initiating and ensuring accreditation and quality assurance at national, institutional and departmental levels. Specific criteria for monitoring and evaluation and performance indicators with regards to training and development must be drawn.
- Every phase must comprise of liaison officers who ensure proper and effective consultation and communication with officers in the other phases.

## 7. Conclusion

The study has found that civil engineering professionals working in South African local municipalities are working under difficult circumstances and little career-related incentives. Local municipalities need to create an enabling environment for professional civil engineers to perform their basic duties optimally and to experience job satisfaction at the workplace. It is strategically beneficial for South African local municipalities to provide civil engineers with career growth paths and development programmes. To this end, tailor-made and skills based training opportunities and attractive remuneration packages should be provided to civil engineers as a means of attracting productive and highly motivated civil engineers into local municipalities. Training programmes must be provided to civil engineers as an incentive. Such programmes of training must be aligned with the operational and business needs and requirements of local municipalities. Local municipalities must forge strategic partnerships and collaborations with key stakeholders such as research and academic institutions with a view to acquire suitable training and development programmes. In line with local and global best practice in the field of civil engineering, a comprehensive monitoring and evaluation programme should be used for monitoring and evaluating the degree of compliance with industry-related guidelines and regulations [38]. Based on findings obtained from the study, municipalities should be encouraged to provide financial subsidies to all its registered civil engineering professionals to assist engineering professionals to maintain their professional registrations with the ECSA. All members of the Engineering Council of South Africa (ECSA) must be forced to comply with continuous professional development (CPD) and regulatory requirements. Financial support should be provided to civil engineers who are unable to pay up their registration fees due to temporary financial difficulties. Students who wish to study civil engineering should be provided with bursaries so that the acute shortage of qualified engineers could be alleviated. Experiential learning placements should be funded by local municipalities so that municipalities stand a chance of employing fresh graduates from universities. Strict disciplinary and legal actions should be taken against people who violate or disregard regulations set out by the ECSA as a means of ensuring professionalism.

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